CIVIL- NEWTON FIRE STATION

Nitsch Engineering has performed research of the existing site conditions located on Centre Street and Willow Street Newton, Massachusetts. Nitsch Engineering's research included review of the Existing Conditions Plan, a site visit, and other available information. Information included in this report is also based on compiled record drawings from the Massachusetts Water Resources Authority (MWRA), MassGIS data, and other documentation gathered by Nitsch Engineering. The MWRA record drawings are not included in this report due to a confidentially agreement that Nitsch Engineering signed with the MWRA.

Figure 1: Aerial Photo (Source: Bing)

General Site Description

The existing Fire Department Headquarters' address is 1164 Centre Street and Station #3's address is 31 Willow (located on the same site) Street in Newton, Massachusetts. The site is 59,692 square feet or 1.37 acres including the existing buildings, parking areas, and associated walkways. The triangular site is bounded by Centre Street to the north-northwest, Willow Street to the north-northeast, the Sudbury River Aqueduct owned by the MWRA to the south. The site slopes down from the MWRA property towards Willow Street. Center Street slopes down at approximately 7% from south to north.

Figure 2:Fire Department Headquarters (Source Newton FD Website)

Proposed Project

Station #3, parking, driveways and walkways will be replaced and Headquarters will be renovated. New utility services will be provided for the new Station #3. The City of Newton (the City) has entered into an agreement to utilize a portion of the MWRA property for a driveway to the new Station #3.

Soils

Based on the Natural Resources Conservation Service (NRCS) Middlesex County Soil Survey, version 14 September 2015, the site is classified as Urban land

The NRCS does not provide Hydrologic Soil Group (HSG) classifications for Urban land.

Middlesex County, Massachusetts (MA017)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	9.1	53.8%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.6	3.7%
629C	Canton-Charlton-Urban land complex, 3 to 15 percent slopes	5.0	29.1%
653	Udorthents, sandy	2.3	13.4%
Totals for Area of Interest		**17.0**	**100.0%**

Figure 3: NRCS MAP

Existing Site Utilities

Storm Drainage - Existing

Stormwater from the site appears to be collected by a closed drainage systems and overland flow that discharges into the drainage system in Willow Street and Centre Street. Two existing 12-inch drain lines connect to the drainage system in Willow Street and one 6-inch drain line into Centre Street. The 12-inch lines appear to collect water from parking area via catch basins and the roof of Station #3. The 6-inch line to Centre Street may be connected to roof drains for the Headquarters building - this will need to be confirmed. Not all drainage connections are understood at this time.

Table 1: Existing Impervious Area

Existing Conditions Areas (Square Feet)				
	Imp-Roof	Imp-Pave	Landscape	Total
Site	27571	13239	18882	59692
MWRA	176	0	5709	5885
Total	27747	13239	24591	65577

62.50% of Impervious Surfaces

There appears to be no stormwater quality measures implemented on the site. There are no known detention, retention, or infiltration systems on the site.

There are no known issues with existing drainage onsite.

Storm Drainage - Proposed

In general, the entire drainage system will be improved to meet the Massachusetts Department of Environmental Protection's (DEP) stormwater standards to the greatest extent practical. The drainage analysis includes the area of the MWRA that will be used for the driveway. A preliminary analysis has been performed to generally understand the impacts of the project and to size detention facilities. At this time we have not included infiltration, once geotechnical investigation is completed infiltration will be investigated.

Table 2: Proposed Impervious Area

Proposed Conditions Areas (Square Feet)				
	Imp-Roof	Imp-Pav	Landscape	Total
Site	25606	15527	18559	59692
MWRA	4024	0	1861	5885
Total	29630	12195	20420	625577

68.86% of Impervious Surfaces

The Schematic Design level plans results an increase of 4,171 square feet of imperviousness, an increase of about 6.4%.

Nitsch Engineering performed preliminary drainage calculations using HydroCAD (TR-20), see below for description of methodology, to size the detention basins. No infiltration was assumed and A soil was used in the calculations which results in the greatest increase in rate of runoff from the increased impervious area on the site.
The Schematic Design includes two proposed underground detention systems. Based on the preliminary drainage calculations these areas will be sufficient to provided detention to reduce the peak rate of runoff during the 100-year storm event to pre-development rates. See Table 3 below and Attachment A: Preliminary HydroCAD Analysis.

Table 3: Pre- versus Post-Development Peak Rate of Runoff

Description	2-Year Storm	100-year Storm
Existing Conditions	1.93 cfs	7.36 cfs
Proposed Conditions	1.17 cfs	6.72 cfs

Once geotechnical investigations are complete, it will be determined if soils on site is suitable for infiltration and determine depth to seasonal high groundwater (SHBW) to ensure the proper offset from SHGW. The Soil Maps indicate an Urban Soil for the site.

In addition to the peak rate mitigation, Water Quality Inlets (WQI) will be installed to treat runoff from paved surfaces. Roof runoff will be directed into the detention systems directly since roof runoff is relatively clean and does not require treatment under the DEP Stormwater Standards.

Methodology - Hydrology and Hydraulics

A drainage area, or subcatchment, is an area where the runoff from that area flows to a point, referred to as a design point. The design point is the focus of the runoff analysis. Peak rates of runoff for the existing and proposed conditions are calculated and compared at the design point.

The rate at which the runoff reaches the design point is determined by a number of factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area.

The slope of the subcatchment area directly affects the amount and rate of runoff from a subcatchment area. With all other things being equal, a site with steep slopes will produce more runoff and transport it at a faster rate than a flat site. With a flat site, the rain will have more time to infiltrate the ground before it flows away as runoff. The slope of the site is easily determined by using an existing conditions survey or by a field examination.

The flow length of a subcatchment area is the longest distance that runoff would have to travel to reach the design point. Flow length is an important factor in determining the time of concentration (T_c). The time of concentration is time for runoff to travel from the hydraulically most distant point of the drainage area to a point of interest in that drainage area, in this case, the design point. The time of concentration influences the volume and rate of runoff. A low T_c will result in more runoff with a higher peak rate than a high T_c.

The type of soil on a site also affects the amount and rate of runoff generated. The soil type found on a site determines the amount and rate at which water can be absorbed into the ground. This is important because the more water that infiltrates the soil, the greater the reduction in the volume and rate of runoff. The Soil Conservation Service categorizes soil into one of four hydrologic soils group: Types A, B, C, and D. Type A soils are the most permeable and Type D soils are the least.

The Soil Conservation Service (SCS) Runoff Curve Number (CN) method is the most commonly accepted method for generating peak rates of runoff from areas. CNs are used to calculate the amount of runoff flowing from a subcatchment area using the surface cover and soil type.

The soil type on the site was determined using the SCS's Soil Survey. The Soil Survey contains soil maps that indicate the location and type of the various soils in the area. Descriptions of the soils and their properties (including hydrologic soil group) are also contained in the survey.

The surface cover on a site refers to what is on the surface of a site, whether it is lawn, roof, pavement, brush, woods, etc. Similarly, to the slope and the type of soil, surface cover affects the rate and volume of runoff. Certain types of cover allow for more opportunity for water to be absorbed into the ground. A site covered with impermeable pavement will not allow for any water to be absorbed into the ground, while a site covered by grass will allow some of the water to be absorbed into the ground. Almost all

the rain that falls on pavement or other impermeable covers will be converted to runoff. In addition, different vegetative covers have different properties concerning producing runoff.

For each subcatchment area, Nitsch determined drainage flow path lengths, surface cover type, and slopes for sheet and shallow concentrated flow. The information was used to determine the time of concentration (T_c) for each subcatchment area. SCS Runoff Curve Numbers (CNs) were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates for the 2-year, 10-year, and 100-year 24-hour storm events were then determined by inputting the weighted CN, T_c, drainage areas, and drainage information into the HydroCAD storm water modeling system computer program.

HydroCAD Version 10.00

The HydroCAD computer program uses SCS and TR-20 methods to model drainage systems. The SCS Runoff Curve Number method uses CNs to classify the runoff characteristics of an area by the type of soil and the type of ground cover. TR-20 (Technical Release 20) was developed by the Soil Conservation Service to estimate runoff and peak discharges in small watersheds. TR-20 is generally accepted by engineers and reviewing authorities as the standard method for estimating runoff and peak discharges.

HydroCAD Version 10.00 uses up to four types of components to analyze the hydrology of a given site. These components are subcatchments (drainage areas), reaches, basins, and links.

Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source.

Once geotechnical investigations are complete, it will be determined if soils on site is suitable for infiltration and determine depth to seasonal high groundwater (SHBW) to ensure the proper offset from SHGW.

In addition to the peak rate mitigation, Water Quality Inlets (WQI) will be installed to treat runoff from paved surfaces. Roof runoff will be directed into the detention systems directly since roof runoff is relatively clean and does not require treatment under the DEP Stormwater Standards.

Sewer

The sanitary sewer currently discharges via an 8-inch pipe to a 24-inch sanitary sewer line in Willow Street. The proposed project will require replacement of the sanitary sewer line. Currently the plans indicate a new 8-inch sanitary sewer line to a new manhole on the 24-inch sanitary sewer line in Willow Street.

Water

The Existing Conditions Plan does not indicate any water lines within the site. There are several water gates located on site. There is a water line indicated on the Existing Conditions plan on the easterly side of Willow Street and in Centre Street. A note on the plans indicates *"Water lines shown hereon were plotted graphically from sewer plan locations, no record size was available from the City of Newton."* A new 8-inch fire service and 4-inch domestic service is proposed for the new Station #3. Additional information is needed to determine the existing water lines on site and where they connect to City water mains. Existing water mains to be abandoned will be cut and capped per City standards.

Natural Gas

Gas lines are indicated in both Centre Street and Willow Street on the Existing Conditions Plans. A new gas line will e installed for the new Station #3. A new gas service is proposed for the new Station #3.

Electrical

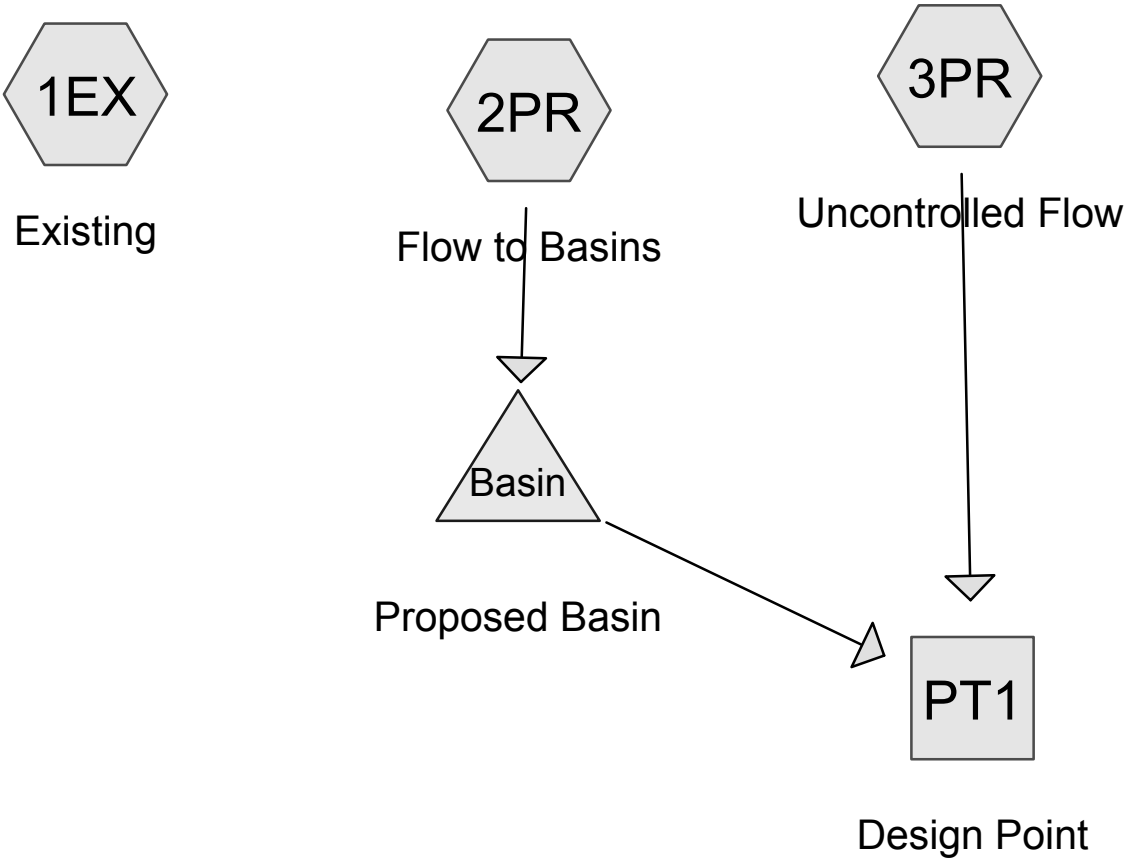
Underground electrical duct banks are indicated in Centre Street. The buildings are currently services from this line. A new electrical service is proposed off this line to a new transformer. There is also a new generator proposed.

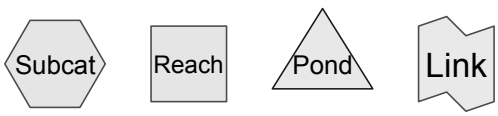
Telecommunications

Underground telecommunicatoins lines are indicated in both Centre Street and Willow Street. The buildings are currently serviced from Willow Street. A new telecommunications service is proposed off the Willow Street line to a communications room in the new Station #3.

ATTACHMENT A

NEWTON FD STATION #3
PRELIMINARY HYDROCAD ANALYSIS
FOR SCHEMATIC DESIGN
JANUARY 26, 2014
NITSCH PROJECT #10193

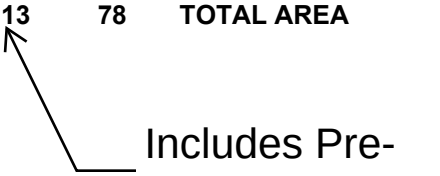




Routing Diagram for 10193 SD Sizing
Prepared by {enter your company name here}, Printed 1/27/2015

Area Listing (all nodes)

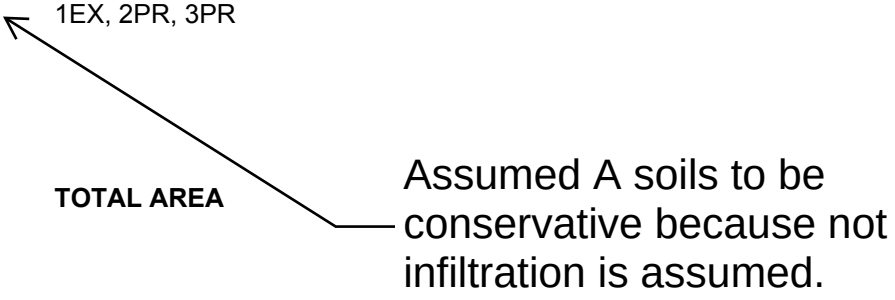
Area (acres)	CN	Description (subcatchment-numbers)
1.033	39	>75% Grass cover, Good, HSG A (1EX, 2PR, 3PR)
0.306	98	Paved parking, HSG A (1EX)
1.037	98	Paved parking, HSG A - Roofs (2PR, 3PR)
0.637	98	Roofs, HSG A (1EX)
3.013	**78**	**TOTAL AREA**



Includes Pre- and Post Areas

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
3.013	HSG A	1EX, 2PR, 3PR
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
3.013		**TOTAL AREA**



Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
1.033	0.000	0.000	0.000	0.000	1.033	>75% Grass cover, Good	1EX, 2PR, 3PR
1.343	0.000	0.000	0.000	0.000	1.343	Paved parking	1EX, 2PR, 3PR
0.637	0.000	0.000	0.000	0.000	0.637	Roofs	1EX
3.013	**0.000**	**0.000**	**0.000**	**0.000**	**3.013**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1EX: Existing Runoff Area=65,667 sf 62.55% Impervious Runoff Depth>1.06"
Tc=6.0 min CN=76 Runoff=1.93 cfs 0.133 af

Subcatchment2PR: Flow to Basins Runoff Area=49,342 sf 79.17% Impervious Runoff Depth>1.71"
Tc=6.0 min CN=86 Runoff=2.39 cfs 0.162 af

Subcatchment3PR: Uncontrolled Flow Runoff Area=16,235 sf 37.54% Impervious Runoff Depth>0.39"
Tc=6.0 min CN=61 Runoff=0.12 cfs 0.012 af

Reach PT1: Design Point Inflow=1.17 cfs 0.174 af
Outflow=1.17 cfs 0.174 af

Pond Basin: Proposed Basin Peak Elev=1.54' Storage=0.027 af Inflow=2.39 cfs 0.162 af
Outflow=1.08 cfs 0.162 af

Total Runoff Area = 3.013 ac Runoff Volume = 0.306 af Average Runoff Depth = 1.22"
34.30% Pervious = 1.033 ac 65.70% Impervious = 1.980 ac

Summary for Subcatchment 1EX: Existing

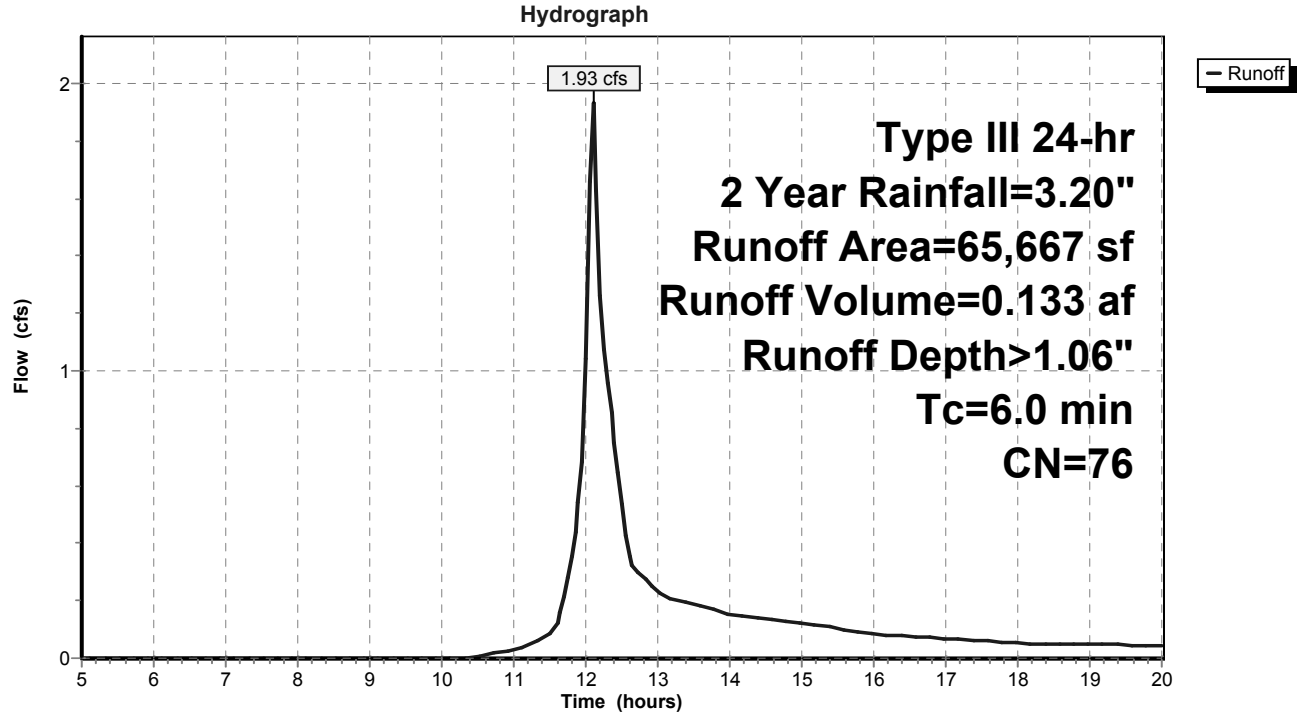
Runoff = 1.93 cfs @ 12.10 hrs, Volume= 0.133 af, Depth> 1.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.20"

Area (sf)	CN	Description
27,747	98	Roofs, HSG A
13,329	98	Paved parking, HSG A
24,591	39	>75% Grass cover, Good, HSG A
65,667	76	Weighted Average
24,591		37.45% Pervious Area
41,076		62.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1EX: Existing



Summary for Subcatchment 2PR: Flow to Basins

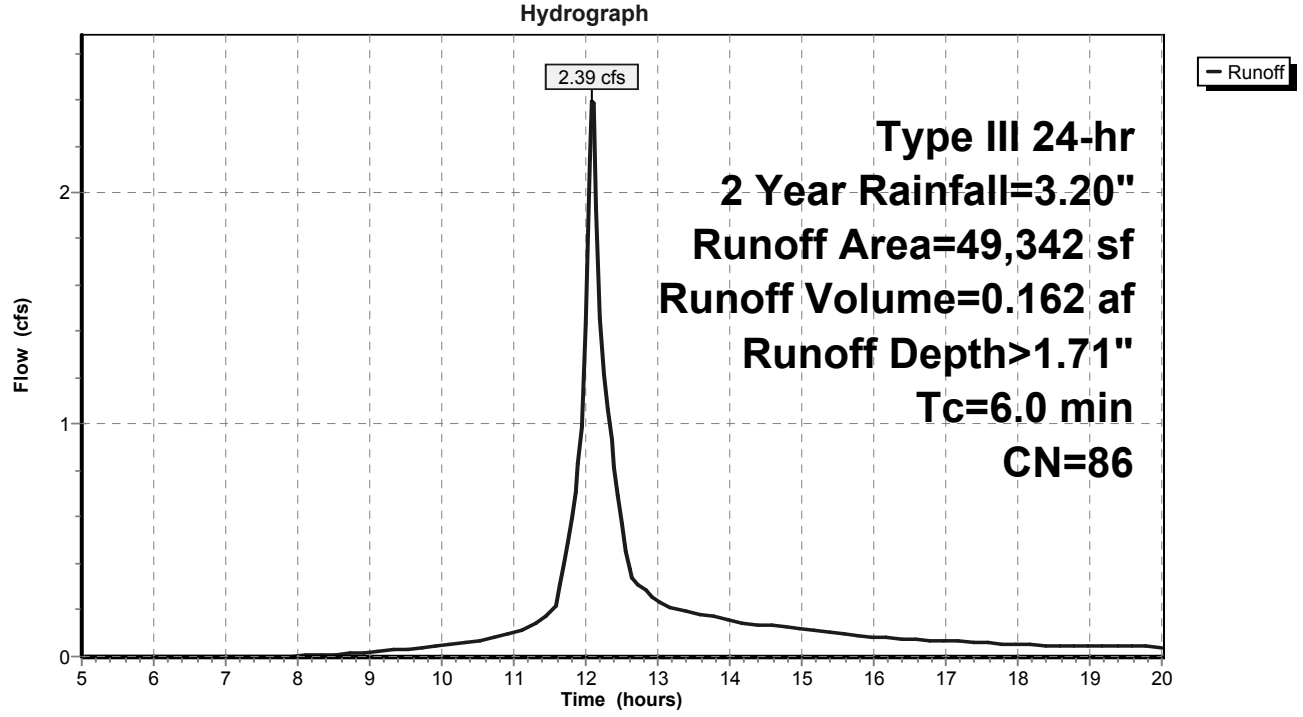
Runoff = 2.39 cfs @ 12.09 hrs, Volume= 0.162 af, Depth> 1.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.20"

	Area (sf)	CN	Description
*	39,062	98	Paved parking, HSG A - Roofs
	10,280	39	>75% Grass cover, Good, HSG A
	49,342	86	Weighted Average
	10,280		20.83% Pervious Area
	39,062		79.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2PR: Flow to Basins



Summary for Subcatchment 3PR: Uncontrolled Flow

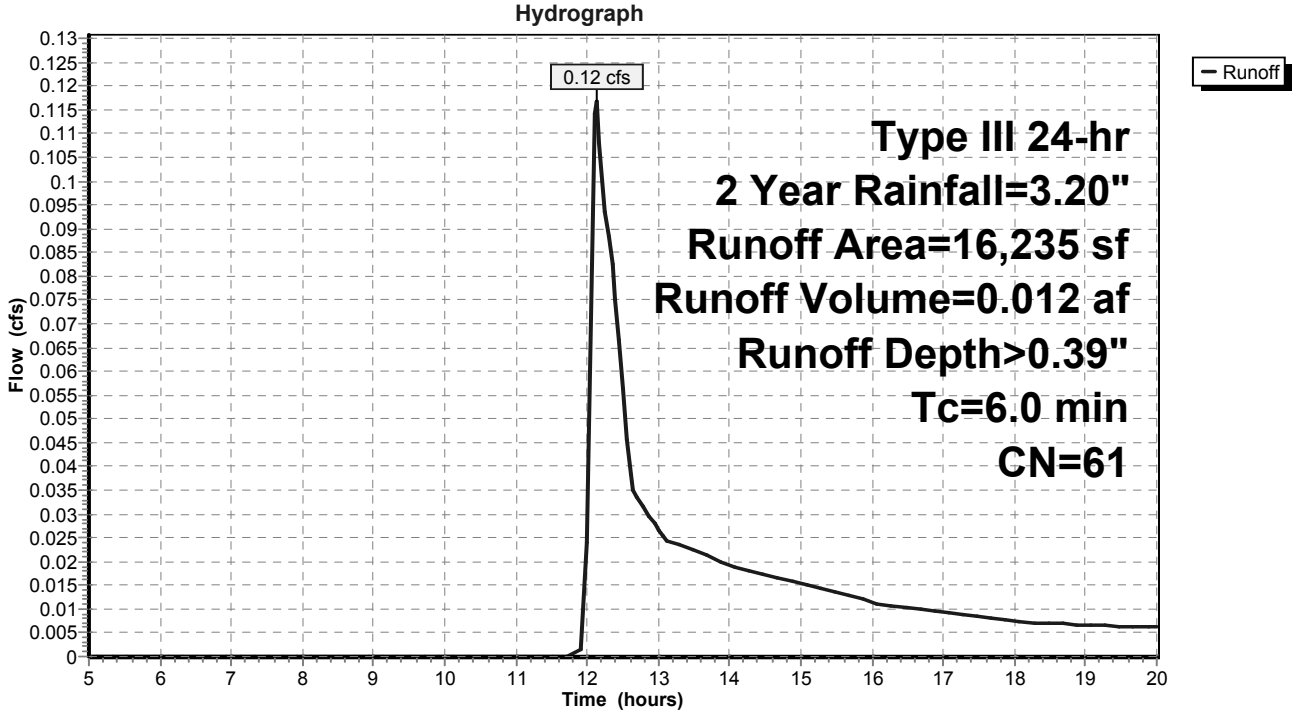
Runoff = 0.12 cfs @ 12.13 hrs, Volume= 0.012 af, Depth> 0.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.20"

	Area (sf)	CN	Description
*	6,095	98	Paved parking, HSG A - Roofs
	10,140	39	>75% Grass cover, Good, HSG A
	16,235	61	Weighted Average
	10,140		62.46% Pervious Area
	6,095		37.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 3PR: Uncontrolled Flow



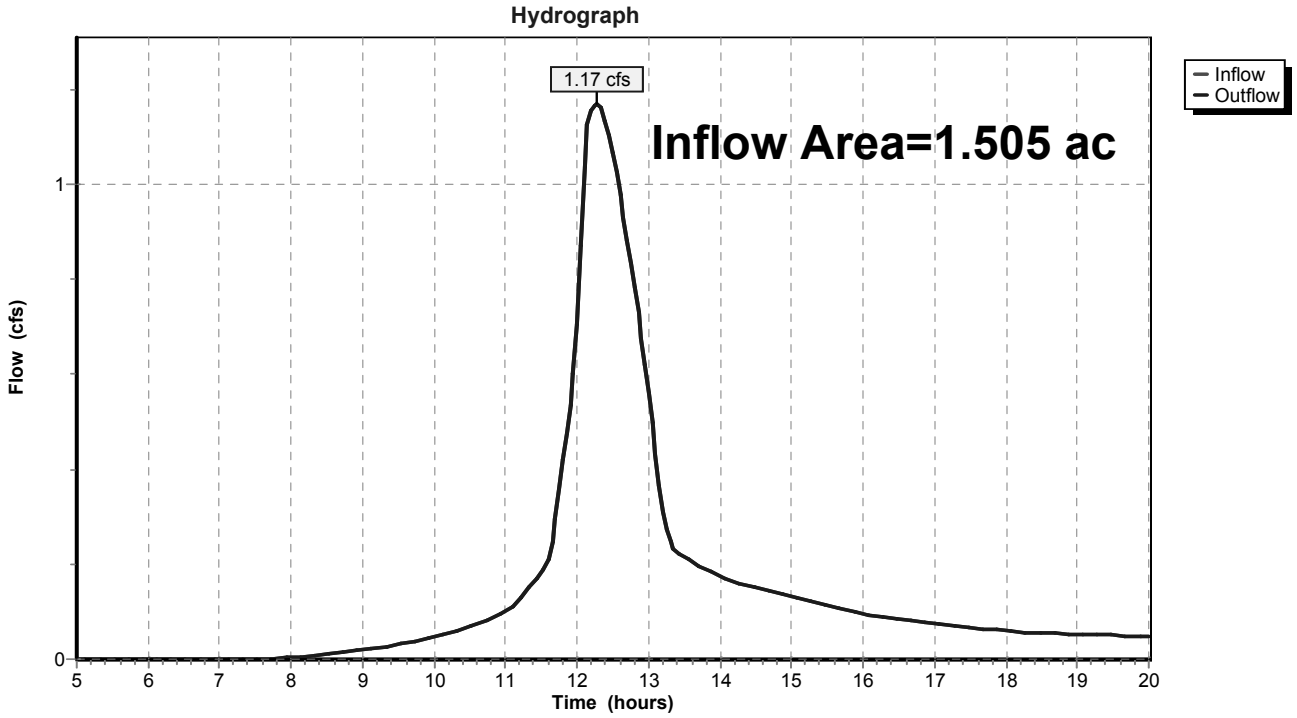
Summary for Reach PT1: Design Point

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.505 ac, 68.86% Impervious, Inflow Depth > 1.39" for 2 Year event
Inflow = 1.17 cfs @ 12.28 hrs, Volume= 0.174 af
Outflow = 1.17 cfs @ 12.28 hrs, Volume= 0.174 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach PT1: Design Point



Summary for Pond Basin: Proposed Basin

Inflow Area = 1.133 ac, 79.17% Impervious, Inflow Depth > 1.71" for 2 Year event
Inflow = 2.39 cfs @ 12.09 hrs, Volume= 0.162 af
Outflow = 1.08 cfs @ 12.30 hrs, Volume= 0.162 af, Atten= 55%, Lag= 12.3 min
Primary = 1.08 cfs @ 12.30 hrs, Volume= 0.162 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.54' @ 12.30 hrs Surf.Area= 0.027 ac Storage= 0.027 af

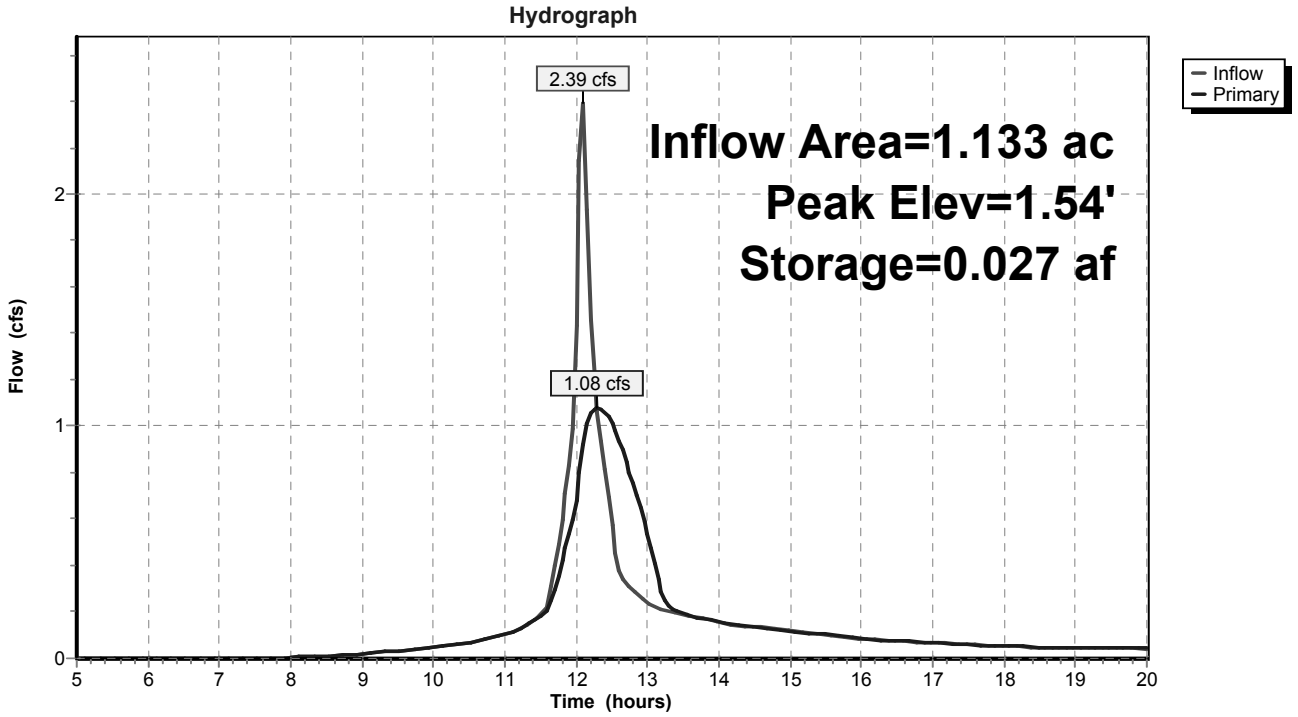
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 7.0 min (794.6 - 787.6)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.065 af	**ADS N-12 36 @ 50.00' L** x 8 Inside= 36.1"W x 36.1"H => 7.10 sf x 50.00'L = 355.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 50.00'L = 443.1 cf

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	2.80'	**4.0' long x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=1.08 cfs @ 12.30 hrs HW=1.54' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 1.07 cfs @ 5.46 fps)
- **2=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.64 fps)
- **3=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond Basin: Proposed Basin



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1EX: Existing Runoff Area=65,667 sf 62.55% Impervious Runoff Depth>3.99"
Tc=6.0 min CN=76 Runoff=7.36 cfs 0.501 af

Subcatchment2PR: Flow to Basins Runoff Area=49,342 sf 79.17% Impervious Runoff Depth>5.07"
Tc=6.0 min CN=86 Runoff=6.74 cfs 0.478 af

Subcatchment3PR: Uncontrolled Flow Runoff Area=16,235 sf 37.54% Impervious Runoff Depth>2.48"
Tc=6.0 min CN=61 Runoff=1.13 cfs 0.077 af

Reach PT1: Design Point Inflow=6.72 cfs 0.556 af
Outflow=6.72 cfs 0.556 af

Pond Basin: Proposed Basin Peak Elev=2.93' Storage=0.061 af Inflow=6.74 cfs 0.478 af
Outflow=5.76 cfs 0.478 af

Total Runoff Area = 3.013 ac Runoff Volume = 1.056 af Average Runoff Depth = 4.21"
34.30% Pervious = 1.033 ac 65.70% Impervious = 1.980 ac

Per City of Newton's Drainage Requirements - 7.0 inches was used for the 100-year 24-hour storm event.

Summary for Subcatchment 1EX: Existing

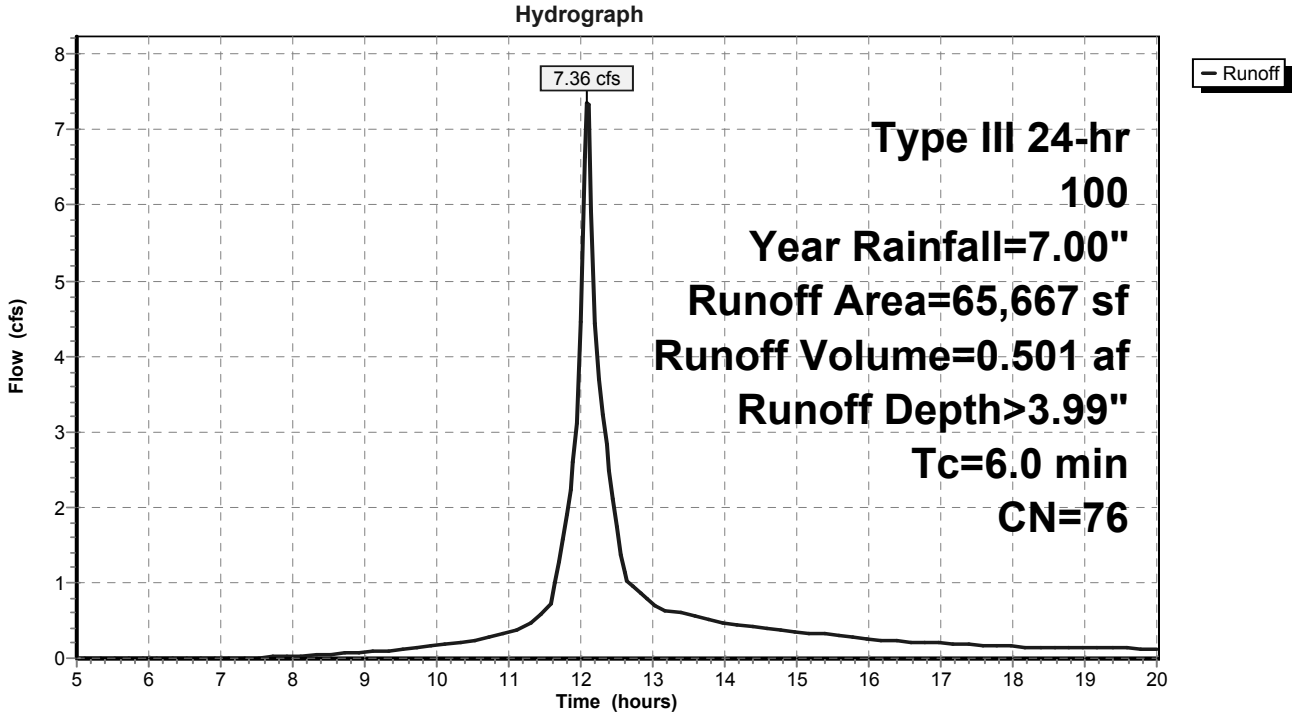
Runoff = 7.36 cfs @ 12.09 hrs, Volume= 0.501 af, Depth> 3.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.00"

Area (sf)	CN	Description
27,747	98	Roofs, HSG A
13,329	98	Paved parking, HSG A
24,591	39	>75% Grass cover, Good, HSG A
65,667	76	Weighted Average
24,591		37.45% Pervious Area
41,076		62.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1EX: Existing



Summary for Subcatchment 2PR: Flow to Basins

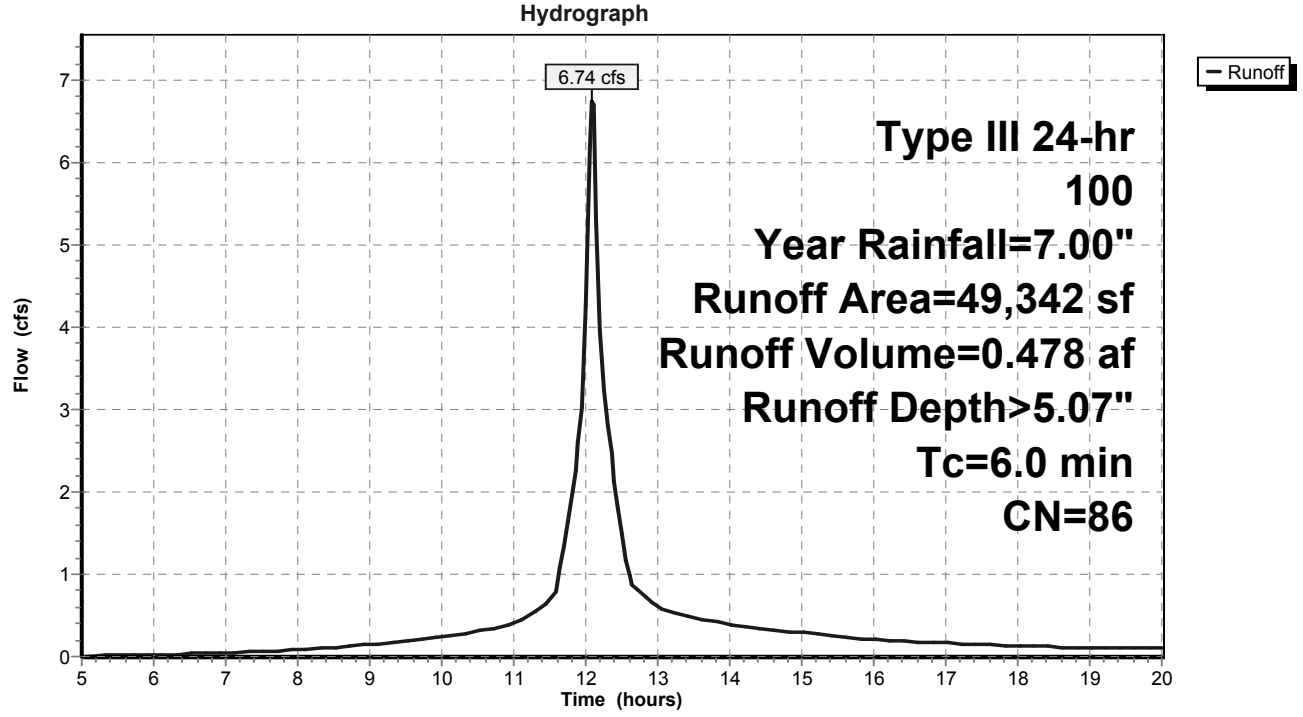
Runoff = 6.74 cfs @ 12.09 hrs, Volume= 0.478 af, Depth> 5.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.00"

	Area (sf)	CN	Description
*	39,062	98	Paved parking, HSG A - Roofs
	10,280	39	>75% Grass cover, Good, HSG A
	49,342	86	Weighted Average
	10,280		20.83% Pervious Area
	39,062		79.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2PR: Flow to Basins



Summary for Subcatchment 3PR: Uncontrolled Flow

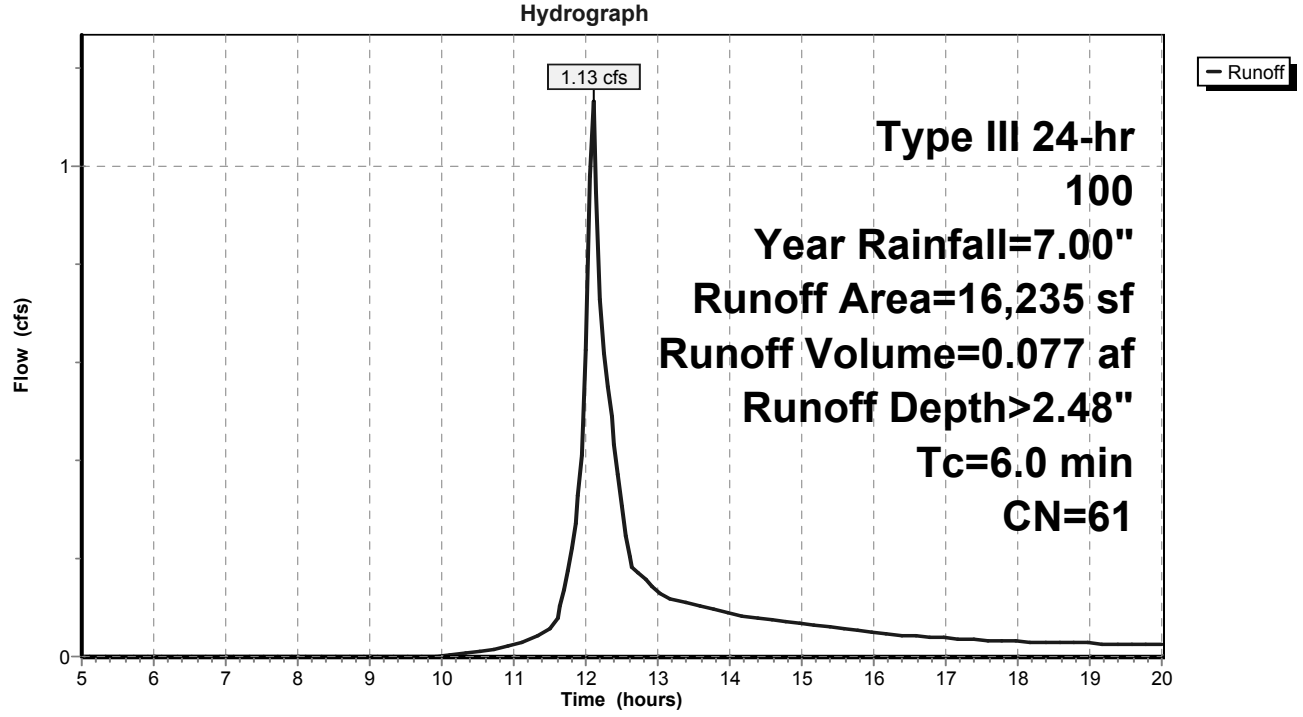
Runoff = 1.13 cfs @ 12.10 hrs, Volume= 0.077 af, Depth> 2.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=7.00"

	Area (sf)	CN	Description
*	6,095	98	Paved parking, HSG A - Roofs
	10,140	39	>75% Grass cover, Good, HSG A
	16,235	61	Weighted Average
	10,140		62.46% Pervious Area
	6,095		37.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 3PR: Uncontrolled Flow



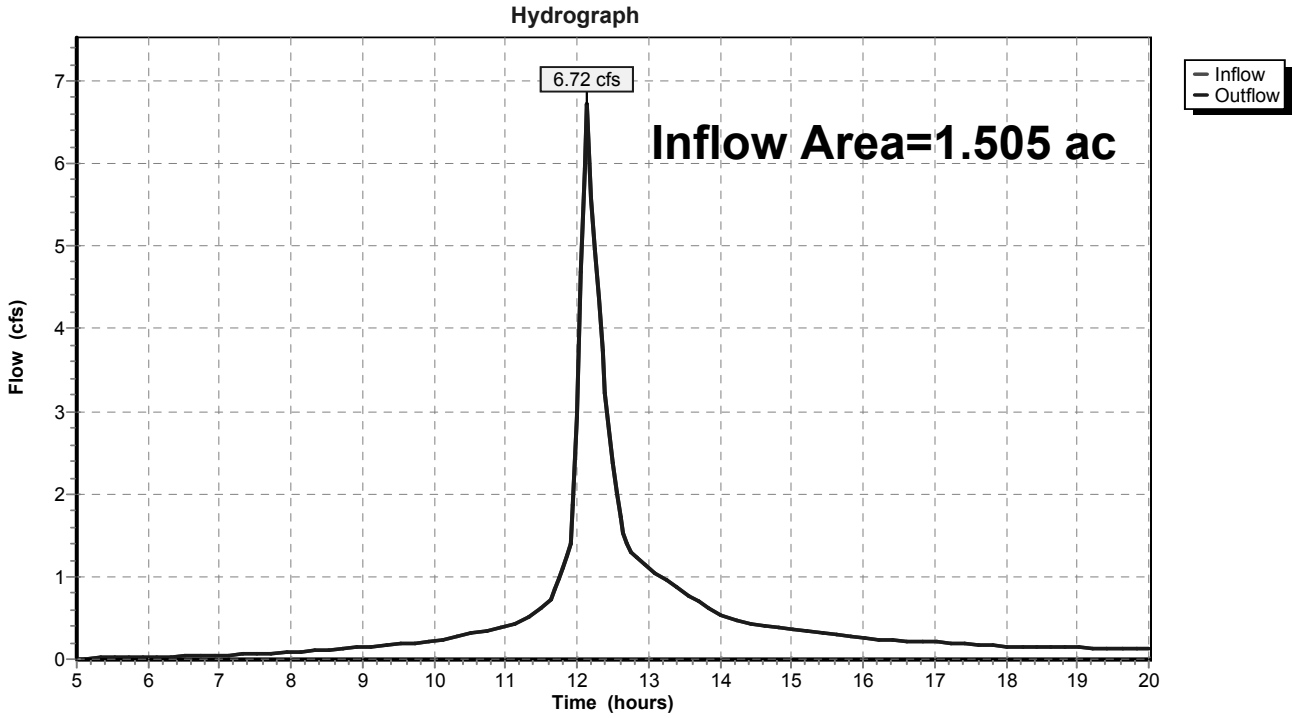
Summary for Reach PT1: Design Point

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.505 ac, 68.86% Impervious, Inflow Depth > 4.43" for 100 Year event
Inflow = 6.72 cfs @ 12.15 hrs, Volume= 0.556 af
Outflow = 6.72 cfs @ 12.15 hrs, Volume= 0.556 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach PT1: Design Point



Summary for Pond Basin: Proposed Basin

[82] Warning: Early inflow requires earlier time span

Inflow Area = 1.133 ac, 79.17% Impervious, Inflow Depth > 5.07" for 100 Year event
Inflow = 6.74 cfs @ 12.09 hrs, Volume= 0.478 af
Outflow = 5.76 cfs @ 12.15 hrs, Volume= 0.478 af, Atten= 14%, Lag= 3.7 min
Primary = 5.76 cfs @ 12.15 hrs, Volume= 0.478 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2.93' @ 12.15 hrs Surf.Area= 0.017 ac Storage= 0.061 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 7.6 min (769.7 - 762.1)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.065 af	**ADS N-12 36 @ 50.00' L** x 8 Inside= 36.1"W x 36.1"H => 7.10 sf x 50.00'L = 355.0 cf Outside= 42.0"W x 42.0"H => 8.86 sf x 50.00'L = 443.1 cf

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#2	Primary	1.50'	**12.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	2.80'	**4.0' long x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.62 (C= 3.28)

Primary OutFlow Max=5.76 cfs @ 12.15 hrs HW=2.92' (Free Discharge)
- **1=Orifice/Grate** (Orifice Controls 1.55 cfs @ 7.87 fps)
- **2=Orifice/Grate** (Orifice Controls 3.64 cfs @ 4.63 fps)
- **3=Sharp-Crested Vee/Trap Weir** (Weir Controls 0.57 cfs @ 1.15 fps)

Pond Basin: Proposed Basin